

PHOTOSYNTHESIS and RESPIRATION

Chapters 8 and 9

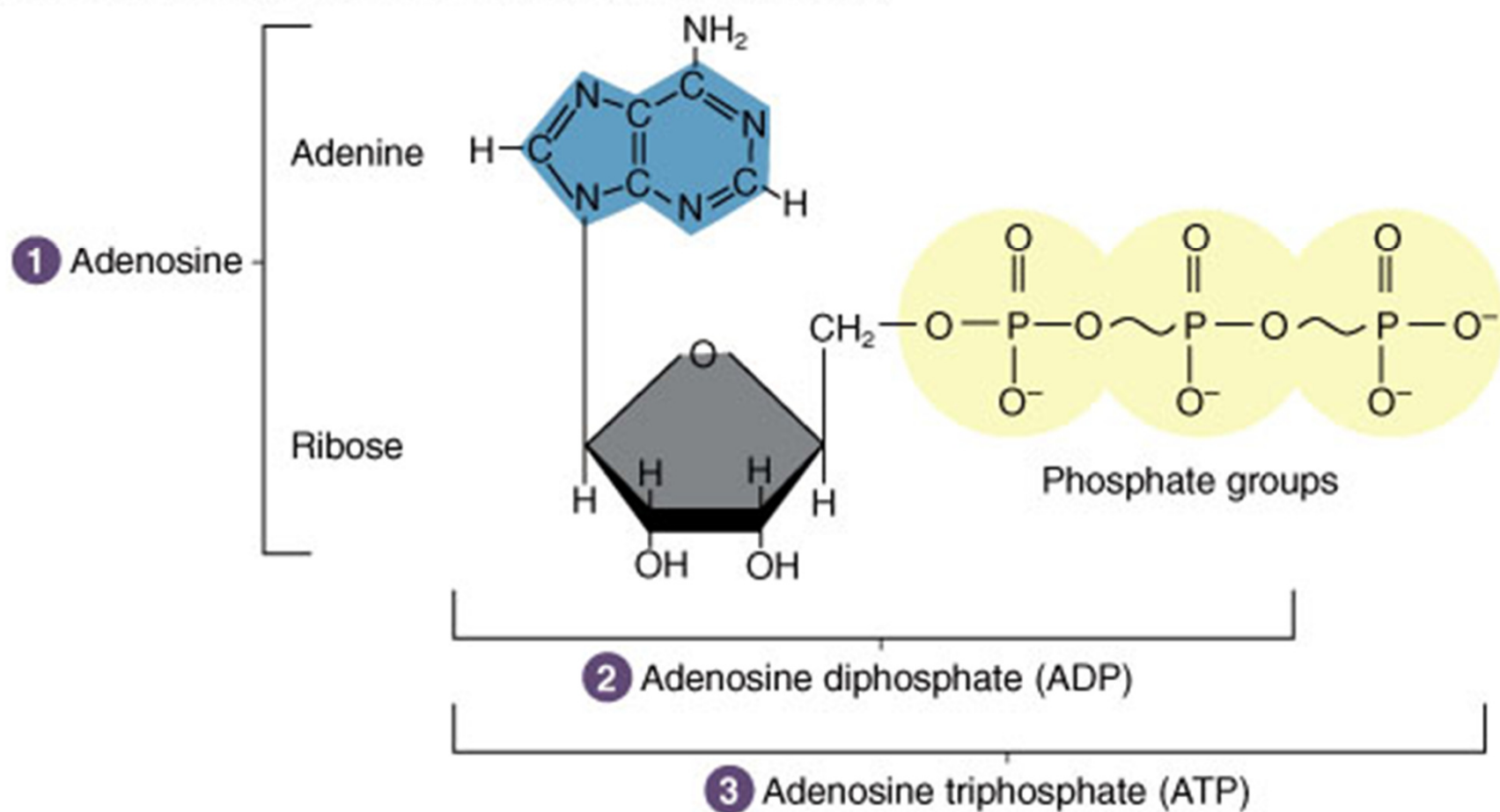
Energy

- Many forms of energy
 - Light
 - Heat
 - Electrical
 - Chemical
- Living organisms use **ATP** to store and release energy



- Adenosine Triphosphate (ATP)
 - Stores and provides energy
 - Consists of
 - Adenosine
 - Ribose and Adenine
 - 3 phosphate groups
 - Energy is stored in bonds between phosphate groups
 - Energy is released when that bond is broken

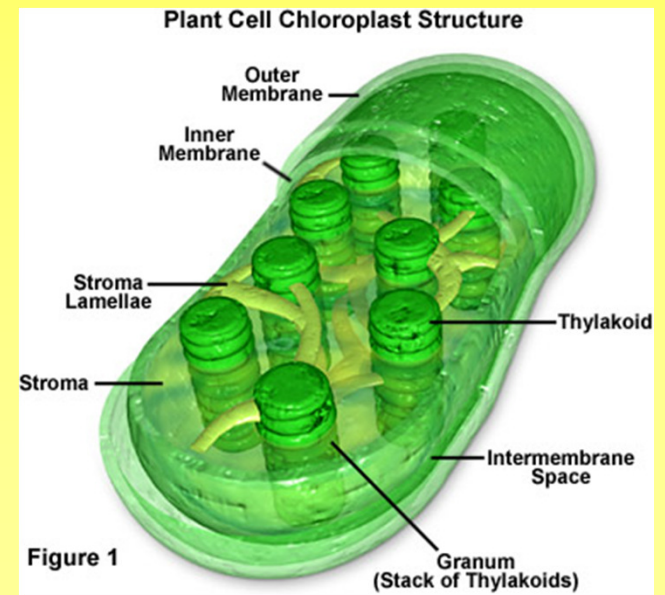
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- **Heterotrophs** =
 - Obtain food by consuming other organisms
 - Ex: Herbivores, carnivores, omnivores, detritivores
- **Autotrophs** =
 - Make their own food
 - Ex: Plants, algae, some bacteria
 - **Photosynthesis** =
 - Converts light energy to chemical energy
 - Reactants
 - Sunlight + Water + Carbon dioxide
 - Products
 - Sugars (Glucose) + Oxygen

Photosynthesis Overview

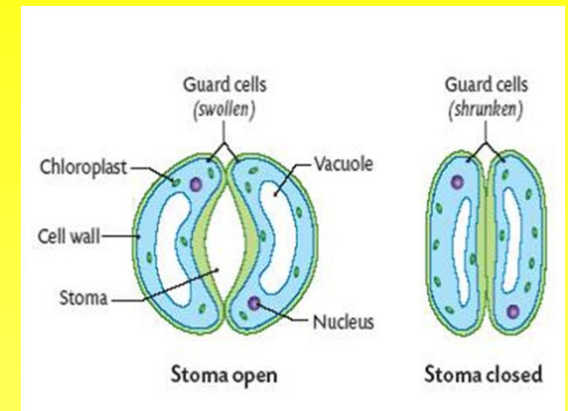
- **Chloroplasts** =
 - Organelle in plants where photosynthesis takes place
 - Contain **chlorophyll** =
 - Principle pigment of plants that absorbs light
 - Absorbs blue-violet and red light well
 - Reflects green light



- Light-Dependent Reactions
 - Uses light to produce ATP
 - Requires water
 - Produces oxygen gas as a byproduct
 - Occur in thylakoid membranes of chloroplast
- Light-Independent Reactions
 - AKA: Calvin Cycle
 - ATP is used to produce sugars from carbon dioxide
 - No light needed directly
 - Occur in stroma of chloroplast

- Factors affecting photosynthesis

- Temperature
- Light intensity
- Water availability



- Adaptations to prevent water loss

- Waxy coatings on leaves
- Guard cells close openings in leaves (stoma)
- CAM plants close stoma during the day (when it is hotter)
 - Gas exchange occurs at night

Cellular Respiration Overview

- **Cellular respiration** =
 - Releases energy from food in the presence of oxygen
 - Reactants
 - Oxygen + Glucose
 - Products
 - Carbon dioxide + Water + Energy (ATP)
 - Energy release is controlled by storing it in bonds of ATP
 - Primarily occurs in **mitochondria** =
 - Organelle that converts chemical energy stored in food to usable energy for the cell (ATP)

- Stages of Cellular Respiration

- 1. Glycolysis

- Glucose is broken down into pyruvic acid
 - Produces some ATP and electron carriers for last stage
 - Occurs in cytoplasm
 - Disadvantage
 - Only a small amount of ATP is produced
 - Advantages
 - Quickly produces ATP
 - Does NOT require oxygen (**anaerobic**)

2. Krebs Cycle

- Pyruvic acid is broken down into carbon dioxide
- Produces some ATP and electron carriers for next stage

3. Oxidative Phosphorylation

- Includes Electron Transport Chain and Chemiosmosis
- Large amounts of ATP produced
 - Increased surface area of cristae allows for more ATP production
- Oxygen is essential
 - Final electron acceptor in ETC

Fermentation

- **Fermentation** =
 - The process by which cells release energy in the absence of oxygen
 - Anaerobic
 - Follow glycolysis if oxygen is not present
 - Occurs in cytoplasm

– **Alcoholic fermentation** =

- Produces ethyl alcohol and carbon dioxide
- Used by yeast and a few other microorganisms
 - Helpful in baking bread

– **Lactic acid fermentation** =

- Does NOT give off carbon dioxide
- Converts pyruvic acid to lactic acid
 - Helpful in production of cheese, yogurt, sour cream, pickles
- Used in muscle cells

Photosynthesis vs Cellular Respiration

- Opposite processes
 - Both transform energy
 - Photosynthesis “deposits” energy in glucose
 - Converts light energy to chemical energy
 - Respiration “withdraws” energy from glucose
 - Converts chemical energy to ATP
 - Both exchange gases
 - Photosynthesis uses CO_2 and releases O_2
 - Respiration uses O_2 and releases CO_2

- Photosynthesis occurs in plants, algae, and some bacteria (but NOT animals)
 - Energy conversion occurs in chloroplasts
- Cellular respiration occurs in nearly all living organisms (including plants)
 - Energy conversion occurs primarily in mitochondria
 - Note: Some organisms use *fermentation* instead to produce energy in the absence of oxygen